Study the Status of 'Learning by Doing Laboratory' in all Schools of Vadodara City

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1. Introduction

The National Education Policy aims to increase focus on all levels of education from school to higher education, strengthening teacher training, reforming the existing exam system, early childhood care and restructuring the regulatory framework of education. The NEP talks about vision of the government for the new setup of 5+3+3+4 plan at school level to support higher education and professional education. The new classification at school corresponds to the age groups classified as 3-8 years (foundational), 8-11 years (preparatory), 11-14 years (middle), and 14-18 years (secondary) respectively. This policy envisions an education system rooted to Indian ethos that contributes directly to transforming India, sustainably into an equitable and vibrant knowledge society, by providing high-quality education to all, thereby making India a global knowledge superpower. It is focused to instill among the learner's knowledge, skills, values and dispositions that support commitment to human rights, sustainable development and global well-being. In the current circumstances and with a collapsing education system, reform such as in the education system was much needed. NEP is a common measure that usually comes along in every few decades. The NEP-2020 focuses on maintaining the curriculum with comparatively reduced academic syllabus, while retaining the core essentials and edging on critical thinking and practical learning. Sufficient approaches are listed in the document with supportive skills.

2. Fundamental principles for the amendments

- Recognizing, identifying and fostering unique capabilities of each student by promoting his/her growth holistic growth in both academic and non-academic spheres
- Emphasis on conceptual understanding rather than learning only for examinations. Creativity, comprehension and critical thinking to promote logical decision-making and innovation. Focus on regular formative assessment rather summative assessment.
- No hard separation between curricular and extra-curricular, or vocational and academic streams. Multidisciplinary and holistic education across sciences, social-sciences, sports, arts and humanities.
- Encouraging multilingualism and the power of language in teaching and learning. Encouraging life-skills such as communication, cooperation, team-work, resilience.
- Ethics and constitutional values such as empathy, respect, pluralism, justice and spirit of service. Respect for diversity and local context in all curriculum, pedagogy, and policy always keeping in mind that education is a concurrent subject.
- Extensive use of technology in teaching and learning, removing language barriers, and educational planning and management.
- Outstanding research as a requisite for outstanding education and development. Continuous review of progress based on sustained research and regular assessment by educational experts.
- There are overall two initiatives that will be undertaken to bring children who have dropped out back to school and to prevent further children from dropping out. The first is to provide effective and

sufficient infrastructure so that all students have access to safe and engaging school education at all levels from pre-primary to Grade-12.

- The second is to achieve universal participation in school by tracking students and their learning levels in order to ensure that they are enrolled in and attending school, and have suitable opportunities to catch up and re-enter school in case they have fallen behind or dropped out.
- To facilitate learning for all students with special emphasis on Socio-Economically Disadvantaged Groups (SEDGs), the scope of school education will be broadened. Open distance learning (ODL) programmes offered by National Institute of Open Schooling (NIOS) and State Open Schools will be expanded and strengthened. Moreover, vocational education courses/programmes and adult literacy and life-enrichment programmes are recommended.

Analyzing policy document with above mentioned points covered under amendment, to a great extent it's clear that all focus is on fundamental literacy and numeracy, practical understanding and skill development.

3. Curriculum and Pedagogy in Schools

- The key focus of the curriculum and pedagogical changes is on holistic development of learners. Curriculum frameworks and transactions will be developed ensuring that skills and values are imbibed through engaging teaching and learning processes.
- To attain the above aim, curriculum content will be reduced in each subject to its core essentials only. The learning will be directed towards inquiry-based, concept-based, discovery-based and analysis-based learning. More interactive methods will be indulged focusing on creativity, problem solving, logical thinking, and collaborative and exploratory activities.
- Experimental learning will be adopted. To do so, hands-on learning, arts-integrated and sports-integrated education, story-telling pedagogy shall be included.
- Students will be empowered by flexibility in choices for courses. There would be no hard separation between 'arts', 'sciences, 'humanities', or between 'vocational', 'academic' courses or 'curricular', 'extra-curricular' and 'non-curricular' streams. This will provide students with exposure and exploration of combinations of wider range of subjects.
- Wherever possible, medium of instruction till Grade-5, preferably till Grade-8, will be home language/ mother tongue/ local language/ regional language. As researches clearly suggest that children tend to pick up languages quickly during early ages and multilingualism has many cognitive benefits, children will be exposed to different languages staring from the Foundation stage onwards. For enrichment of students and preservation of the rich Indian literature tradition there will be option of learning at least two years of a classical language and its literature. Foreign languages like Korean, Japanese, French, German, Spanish, Portuguese and Russian will also be offered at secondary level.
- The main aim will be to provide quality textbooks at lowest possible costs- namely at the cost of production/ printing- in order to mitigate burden of textbook prices on students. NCERT curriculum would be taken as nationally acceptable criterion, and the availability of such textbooks in all regional languages will be top priority. All efforts will be made to ensure timely availability textbooks and access to downloadable and printable versions of all textbooks will be provided by all States/UTs and NCERT.

Here, in NEP 2020 focus widely on Mathematics education and considered it as very essential subject of the curriculum due to is wide-spread applications in all walks of life, make it attractive as most of find it boring and to make all understand that it is beyond numbers. It is a subject of measurements, data, shapes and logical activities which has a huge scope in fields like medicine, engineering, finance, economics, natural sciences, management etc. the main goal of mathematics education in schools is for clarity of thoughts, pursuing assumptions to logical conclusions, handle abstractions and develop a problem-solving approach.

4. Mathematics in Middle School (Upper Primary)

- Mathematics at the upper primary stage can address many problems from everyday life and offer tools for addressing them. Moving from number sense to number patterns and seeing relationship between numbers bring useful skills by applying and looking for patterns in these relationships. Algebraic notations, use of variables setting up and solving linear equations and factoring are means by students gain fluency and attain a wide range of exploration of solutions to real world problems.
- Various regular shapes are introduced to students. They start relating objects around them to these shapes and try to approximate the seemingly irregular shapes by regular ones. They began to comprehend the idea of space and start associating shapes around them to area, parameter, etc. This suggests that mensuration is best when integrated with geometry.
- Visualization is yet another important aspect introduced at this stage of learning by use of data handling and representation. Visual learning fosters understanding, imagination and organization. This can indulged by using data in daily life for illustration, use of railway timetables, flowcharts of daily activities, picture diagrams of routine procedures, etc.

Problems in Teaching and Learning of Mathematics

Position paper, National focus group on teaching of mathematics, states four major problems with teaching and learning of mathematics at school levels, namely:

- A sense of fear and failure regarding mathematics among majority of children
- A curriculum that disappoints both talented minority as well as the non-participating majority at the same time
- Crude methods of assessment that encourage perception of mathematics as mechanical computation
- Lack of teacher preparation and support in teaching of mathematics

Majority of the above-mentioned problems can be resolved by the teaching and learning approaches proposed by the NEP-2020. It suggests constructive approach, inquiry-based, conceptual problem solving based and experimental based learning.

5. Learning Mathematics with NEP-2020

- Constructive approach radically changes the process of teaching and learning mathematics, connecting it with daily life, rather than teaching only abstract formulas and using a creative approach to mathematical tasks solving. Actions such as investigation, imagination, research and posing questions are performed by students in order to build knowledge rather than just receiving it. In a constructive classroom, students build ideas upon their prior knowledge, understanding and experiences.
- Inquiry-based learning involves student-centered activities that develop confidence and ability of problem solving on their own. It starts by proposing questions rather than just stating established facts or portraying a smooth path to knowledge. Problem posing, modeling activities and problem solving are the main aspects of inquiry-based learning. Using inquiry-based learning, students can perceive knowledge in accordance to their understanding by exploration, explanation and engagement making it more meaningful for the students.
- NEP-2020 has also proposed the use of Experiment-based/ experiential learning. This basically refers to method of learning by doing. It encourages the students to have experiences with materials via activity-based approaches, rather than learning through someone's experiences recorded in textbooks and lectures. Method like this might be helpful in subjects like mathematics as students are involved in their own understanding and perceptions of mathematical concepts and practices. Introducing experimental learning activities in mathematics classroom contribute towards not only creating an innovative environment for students to overcome their math anxiety, but also enjoy the burden-free learning process. For instance, in middle-school the activity of selling self-made items involving purchasing, measuring, etc can help students reflect up on the process they adopted for all

activities; at secondary levels concepts like probability can be taught through experiential learning by using concrete materials like coins, cards, dice, etc. rather than just theoretical lectures.

- Problem-based learning is yet another learner-centered approach. The concepts become more comprehensible when they are derived from real world situations. Problem-based learning environment provides for the student to create, conjecture, analyze, explore, testify and verify the mathematical situations at hand. In this approach the teacher provides meaningful instructions to the learner, and following those the learner identifies the problem, devise a plan to solve it and implement it by reflecting on the plan. This stimulates creativity, critical thinking and problem-solving abilities in students.
- Technology-enabled learning increases the efficiency in all spheres of education. For instance, the use of mobile applications for teaching and learning mathematics enhances technological, social and conceptual learning. Using blended learning can also be considered as one approach, which involves the blending of use of technology and traditional in-person learning, as teachers will have a varied range of aids to help students with concepts of trigonometry, arithmetic, algebra, and statistics via several resources like online videos and exercise applications.

The suggested NEP guideline for Mathematics teaching-learning process through different approaches are mentioned above and for the purpose the government of Gujarat has provided with Learning By Doing Laboratory (LBDL) in all Government upper primary schools. Here, researchers had surveyed the status of LBDL in all schools of Vadodara City. Moreover, government for this purpose joined hand with NISCHAL group. The Nischal has provided the hand book for the purpose.

6. Objectives of the study

1.To study the grant utilization under Learning by Doing Laboratory
2.To find the working condition of this laboratory
3.To study the methods used to teach in Learning by Doing Laboratory

7. Population

All schools managed by Nagar Prathmik Shixan Samiti (NPSS), Vadodara. Here, in total 120 schools are there, providing medium of instructions as Gujarati, Hindi, English and Marathi in different schools. From these 120 schools 77 schools are allotted with Learning by Doing laboratory.

8. Sample

Sample was selected by stratified random sampling technique. Here, these 77 schools of NPSS, Vadodara are spread among 16 different clusters and from each cluster one school is selected as sample for the study.

9. Tools

Tools prepared under the present study for
Objective 1: Checklist was prepared based on NISCHAL's handbook. There were 30 items on checklist.
Objective 2: Observation schedule to realize actual situation of laboratory in the schools.
Objective 3: Semi structured interview for the principal and math-science teacher of the school.

10. Data collection procedures

Researcher with the help of cluster resource coordinator visited the selected school. Researcher checked the Laboratory dead stock register and voucher file for checklist. Observation schedule was used to check working condition of Laboratory. Semi structured interview was administered on Principals and teachers of the school for studying methods, techniques, approach and skills used to teach under LBDL.

11. Data Analysis Technique

The data were analyzed using the mixed (Descriptive and Inferential) statistical techniques like Frequencies, Percentage, and content analysis.

12. Findings

Under objective 1 are --

- 100% schools were well equipped with the apparatus, chemicals and all other equipment.
- The equipment was provided by government to the selected schools well in advance before students after pandemic came back.
- These schools were provided with 25000 one-time grant. The grant can be utilized to purchase require equipment, planning activities for students, providing hand on experience to students, exposure visits, travel expense for other schools to visit such laboratory.
- 12.5% of schools have utilized for revamping the laboratory condition.
- 37.5% of schools spent it for exposure visits and providing hand on experience to students.
- 50% has utilized it for purchasing required chemicals and providing transport to other schools for visiting their laboratory.

Under objective 2 are –

- The LBD lab is usual Science laboratory having arrangement of practicing activities by students.
- Many schools are having the science laboratory where they have made arrangement for LBDL.
- There were few schools with less classrooms, here laboratory with all arrangements is not possible.
- There were schools where all necessary infrastructure was there but teachers were not there to make it possible.
- 20% schools still have not used the equipment given to them. Those are only on dead stock register and students have not seen yet.
- “Gradually teacher will develop this kind culture provided that infrastructure available”
- Many things are in bulk whereas what actually needed was missing, in today’s context the equipment needed to be updated and changed.
- Not a single school has laboratory with sink facility to dispose chemicals.
- There were lack of siting arrangement and big table for demonstration was missing.

Under objective 3 are –

- Teachers and students have tried to make it possible the government concept of learning by doing.
- There were schools where students were unaware about the concept of LBD, also science and mathematics were taught by lecture method.
- Teachers were showing practical to students in most of the schools and students were observing and noting down the results.
- But there were schools where teachers are actually providing on hand experience to students, students do experiments by themselves and recording the outcomes. Arrive at the conclusion.
- 80% of schools are having Mathematics-Science teacher and teachers were well learned in practical approach of teaching.
- Teachers were aware about the concept of learning by doing, enquiring based learning, problem based learning and practical approach.
- But teachers were not well trained in constructivist approach.
- Teachers were ready in taking initiative towards new approach, just condition that they are given space and time to do.

13. Conclusion

As step forward towards NEP 2020 the laboratory experience gives you the opportunity of seeing, touching, smelling, and hearing the structures and materials you learn about in class. What you do in the lab helps you correlate the text and lecture with study of real organisms. You will also gain practical

experience while performing and you can see structures and relationships with your own eyes. In addition, you will perform scientific experiments to help you gain an appreciation of the scientific method. Good lab work involves persistent, precise, and critical observations. It demands an orderly and systematic classification of facts, repetition of technical procedures, and frequent checking of observations and results. Hence, the practical approach for teaching Mathematics-Science subject is greatly optimistic step towards achieving next generation goals.

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